at the Royal Academy. An exhibition of his sketches held after his death comprised more than a hundred separate pictures.

Himself probably the most eloquent of scientific exponents since Tyndall, it is interesting to learn that Thompson fully realised, as has many another, the difficulties pertaining to the giving of a Royal Institution discourse, where it is not unusual for some few of the audience to know quite as much as, if not more than, the lecturer, while the majority can fully understand but little of what they hear. Of interest also is the account of the slender beginnings of his library, which his proclivities as a collector and as a learned bibliophile led him to accumulate, until, enriched as it was by many ancient works and a whole host of rare pamphlets, it developed into one of the most complete and valuable existing collections of electrical publications.

It is satisfactory to know that the skill and labour expended in making this collection will not be thrown away, as the whole library is to be preserved intact at the Institution of Electrical Engineers, where it will form a worthy monument to Thompson's industry and discernment.

A. A. CAMPBELL SWINTON.

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## Academic Research and Industrial Application.

*The Chemistry and Technology of the Diazo-Compounds.* By Dr. J. C. Cain. Second edition. Pp. xii + 199. (London: E. Arnold, 1920.) Price 12*s*. 6*d*. net.

THE important chapter in organic chemistry which is summarised so admirably by the author of the treatise under review affords a striking illustration of the difficulty of explaining the details of a chemical synthesis to a non-chemical, although scientific, audience.

The element carbon furnishes the framework or skeleton of all organic compounds, but much of the chemical liveliness appertaining to the more reactive of these substances is due to nitrogen, an element endowed with a dual personality. In the free state inert and loath to enter into chemical combination, when combined it becomes extremely active. Everything living that grows contains nitrogen, and this element is also present in all organic explosives and in the physiologically active alkaloids. It is, therefore, not surprising that the study of organic nitrogenous substances has always had a great fascination for chemists, who have never grown tired of speculating on the molecular structure of these compounds. It was from this academic point of view that about sixty years ago Prof. Kolbe, of Marburg, set his pupils to work on the action of nitrous acid on various aromatic amines, nitrogenous compounds of the ammonia type derived from the aromatic hydrocarbon, benzene. One of these workers was Johann Peter Griess, who, on treating picramic acid with nitrous acid, discovered the first diazo-compound, so called because its molecule contained a very reactive group, $N_2$, consisting of two atoms of nitrogen or azote.

Purely as a matter of scientific curiosity and without any thought of possible applications, Griess proceeded to generalise this reaction and succeeded in showing that the common primary aromatic amines yielded diazo-compounds. These diazo-derivatives, he found, were very reactive compounds, and he tried their action on all possible substances. He was thus led to make a discovery of the utmost technical importance, namely, the synthesis of the azo-colouring matters. The diazo-reaction itself was discovered in 1858, and Griess obtained the first azo-colour in the years 1861–62. This dye was first manufactured in 1865 by Caro, a German chemist then employed by Messrs. Roberts, Dale, and Co., of Manchester. The greater part of Griess's work was carried out in England, first in London in Hofmann's laboratory, and afterwards while engaged with Messrs. Allsopp, of Burton-on-Trent.

From those early days to the present time the diazo-reaction has gone on becoming increasingly useful both in technical and in academic chemistry. The azo-colours produced a revolution in the art of dyeing because a large and important group was found to have the valuable property of dyeing cotton directly without the intervention of a mordant. Other azo-dyes have found useful application as extremely fast mordant dyes on wool. A third group, the azo-pigments or ingrain dyes, are formed within the textile fibre by impregnating this material successively with the components of the azo-coupling. All students of organic chemistry are familiar with the Sandmeyer and Gattermann reactions, by means of which diazo-compounds become synthetic agents useful in elucidating the constitution of aromatic or benzenoid derivatives. The diazo-reaction has been of service in the production of synthetic drugs, notably those of the salvarsan group. It was employed during the war in the manufacture of sternutatory materials for chemical warfare. These synthetic developments are all duly noted in Dr. Cain's treatise, which includes many references to original literature. To the student of historical chemistry not the least interesting chapters will be those on the theories of the constitution of diazo-compounds. This discussion

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deals fully with the celebrated Hantzsch-Bamberger controversy, which was maintained for several years. The author has himself formulated a theory of the constitution of diazonium salts which, with a modification suggested by the reviewer, is sufficiently elastic to account for the properties of aromatic diazo-compounds and also for the existence of a rapidly increasing group of heterocyclic and non-aromatic diazo-derivatives. A new chapter on the latter group has been added to this second edition of a unique monograph.

G. T. M.

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## Ancestral Studies of Compositæ.

*The Origin and Development of the Compositae: Thesis approved for the Degree of Doctor of Science in the University of London.* By Dr. James Small. (*New Phytologist* Reprint, No. 11.) Pp. xi + 334 + 6 plates. (London: William Wesley and Son, 1919.) Price 15*s.* net.

THERE is perhaps a tendency among systematic botanists to fight shy of the Compositæ, on account largely of the enormous size of the family and the difficulties of properly classifying its members. Those, however, who once succeed in passing these lions in the path soon become enthusiastic students of the group, and Dr. Small is no exception to this rule. His contribution to the investigation of the origin and development of the family is by far the most important that has appeared for many years.

After a general discussion of previous literature, in which the most important names are those of Cassini and Bentham, the author goes on to deal with the various morphological and ecological features of the family one by one, considering, for example, the pollen-presentation mechanism, the corolla, the pappus, the involucre, the receptacle, the phyllotaxis, and the fruit dispersal From all of these, similar general conclusions are drawn, to the effect that the Senecioneæ are the most primitive type of the family, and that from them, directly or indirectly, and ultimately from Senecio itself, as the basal genus from which the Senecioneæ arose, there sprang all the other tribes and genera of the family. This is then very strikingly confirmed by a study of the geographical distribution, which shows what would be expected upon this theory of mutational origin, and upon the hypothesis of age and area, which is likewise adopted. It is shown that the distribution of Senecio (the oldest genus) is the widest of all, and that of other tribes and genera less and less in proportion to their lesser age.

Senecio is supposed (and the evidence is fairly clear) to have arisen from the Siphocampylus group of Lobelioideæ, and probably in the Bolivian highlands after the upheaval in the Cretaceous period had provided available land above the limit of trees. Once formed, its pappus fruit and the great area of open land available in the mountain chains which with few breaks run all round the world enabled it to spread rapidly over America, Asia, Africa, and Europe.

In the final chapter an interesting sketch is given of an hypothetical evolution of the Compositæ from Senecio, based upon the various conclusions drawn in the course of the work, summed up largely in a diagram on p. 297, which illustrates this evolution in time and space. The second great genus to evolve is supposed to have been Gnaphalium (from which the Inuleæ are descended), then Spilanthes (Heliantheæ), Solidago (Eupatorieæ and Astereæ), and so on. The whole is a striking and interesting illustration of the way in which our whole outlook upon phylogeny has been altered by the acceptance of the modern theories of evolution and geographical distribution.

In the course of the work many minor points are further elucidated, such as irritability in the pollen-presentation mechanism. Good reasons are brought forward for supposing the pappus to be of trichome nature, and by an ingenious mechanism the dispersal of the seed was studied, and it was shown that a very slight wind was sufficient to keep the seeds aloft in sufficiently dry air, so that there is no need for land bridges to explain the distribution. Many other points are also dealt with, for which reference must be made to the original.

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## Our Bookshelf.

*Monarch: The Big Bear of Tallac.* By Ernest Thompson Seton. Pp. 215. (London: Constable and Co., Ltd., 1920.) Price 7*s.* 6*d.* net.

THIS is a composite picture of a grizzly bear, or, more exactly, the personality of one remarkable bear still living in prison has been credited with the adventures of several of his kind. Beginning with the growth and education of the cub, the book tells the story of many ups and downs, such as the first sheep-stealing, the escape from the forest fire, the circumvention of the hunters; the affair of the ten-gallon empty sugar-keg with the delicious smell, into which the bear thrust his head; and the final capture (by means of drugged honey) of an adventurer with many aliases. Mr. Thompson Seton is a fine raconteur, but we wish he had put a little more stuffing into the book; and his literary facility sometimes gets

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